110

OPERATING INFORMATION

AUTOMATIC PRESELECTOR

8445B

DUPLICATE OF SECTIONS 1 THRU 3
OF YOUR OPERATING AND SERVICE MANUAL

KEEP WITH INSTRUMENT

JUNE 1975

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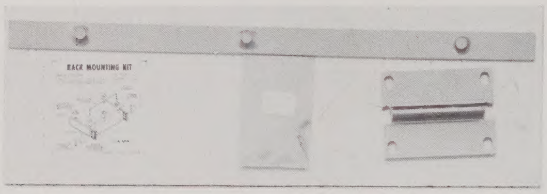
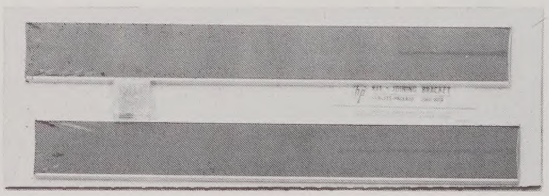
HEWLETT hp PACKARD

MODEL 8445B (OPTION 002/003)

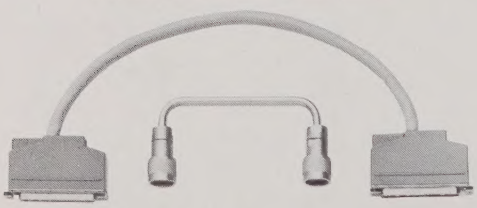


RACK MOUNTING KIT

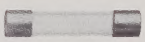


JOINING BRACKET KIT

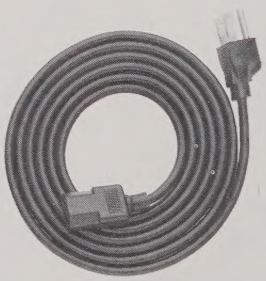
INTERCONNECT CABLE



RF INTERCONNECT CABLE



FUSE



LINE POWER CABLE

NOTE: See ACCESSORIES SUPPLIED in Table 1-3 for part number information.

Figure 1-1. Model 8445B and Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test, adjust and service the Hewlett-Packard Model 8445B Automatic Preselector. This section covers instrument identification, description, options, accessories, specifications and other basic information.

1-3. Figure 1-1 shows the Hewlett-Packard Model 8445B Automatic Preselector with Option 002 (manual tuning controls) and Option 003 (digital readout of center frequency).

1-4. The various sections in this manual provide information as follows:

SECTION II, INSTALLATION, provides information relative to incoming inspection, power requirements, mounting, packing and shipping, etc.

SECTION III, OPERATION, provides information relative to operating the instrument.

SECTION IV, PERFORMANCE TESTS, provides information required to ascertain that instrument is performing in accordance with published specifications.

SECTION V, ADJUSTMENTS, provides information required to properly adjust and align the instrument after repairs are made.

SECTION VI, REPLACEABLE PARTS, provides ordering information for all replaceable parts and assemblies.

SECTION VII, MANUAL CHANGES, normally will contain no relevant information in the original issue of a manual. This section is reserved to provide back-dated and up-dated information in manual revisions or reprints.

SECTION VIII, SERVICE, includes all information required to service the instrument

1-5. Supplied with this manual is an Operating Information Supplement. The Supplement is a copy of the first three sections of the manual, and should be kept with the instrument for use by the operator. Also included with the manual is an Overall Schematic Diagram. Additional copies of both the Operating Information Supplement and the Overall Schematic Diagram can be ordered separately through your nearest Hewlett-Packard office. The part numbers are listed on the title page of this manual.

1-6. Also listed on the title page of this manual is a Microfiche part number. This number can be used to order 4 x 6-inch microfilm transparencies contains up to 60 photoduplicates of the manual pages. The Microfiche package also includes the latest Manual Changes supplement and all pertinent Service Notes.

1-7. SPECIFICATIONS

1-8. Specifications for the instrument are listed in Table 1-1. These are the performance standards the instrument is tested against. A list of typical operating characteristics is provided in Table 1-2. They are included as additional information only; they are not specifications.

1-9. SAFETY CONSIDERATIONS

1-10. General

1-11. This is an International Electrotechnical Commission (IEC) Safety Class I instrument, designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring Apparatus." It has been supplied in safe conditon.

1-12. Operation

1-13. BEFORE APPLYING POWER, make sure the ac input to the instrument is set for the available ac line voltage, that the correct fuse is installed (Figure 2-1), and that all normal safety precautions have been taken.

1-14. Service

1-15. Although the instrument has been designed in accordance with international safety standards,

Table 1-1. 8445B Specifications

SPECIFICATIONS

Frequency Range: Dc to 1.8 GHz Low-Pass Filter. 1.8 to 18 GHz Tracking Filter.

Digital Frequency Readout (Option 003):

Resolution: 1 MHz
Accuracy: 0.01 to 1.0 GHz: ±6 MHz
1.0 to 4.0 GHz: ±8 MHz
4.0 to 18.0 GHz: ±0.2 %

Out-of-Band Rejection: For YIG tuned filter 1 GHz from center of passband > 70 dB.

Limiting Level: > +5 dBm (Maximum input level for < 1 dB signal compression).

Burnout Level: > +20 dBm.

Hysteresis: < 25 MHz.

Tuning Linearity: < ±10 MHz.

Insertion Loss:

	Frequency	Insertion Loss (except Option 004)	Insertion Loss Option 004
Low-Pass Filter	Dc – 1.8 GHz @ 2.05 GHz	< 2.5 dB > 50 dB	*
Tracking Filter (YIG)	1.8 – 12 GHz 12 – 18 GHz	< 8 dB < 10 dB	< 7 dB < 8 dB

*Low-Pass Filter deleted with Option 004.

Table 1-2. Typical Operating Characteristics

TYPICAL OPERATING CHARACTERISTICS

Tracking Filter 3 dB Bandwidth: Typically 20-45 MHz.

Tracking Filter Skirt Roll-off: Characteristics of a three-pole filter.

Input VSWR: Typically < 2.0 (1.8 – 18 GHz).

8555A Local Oscillator Emission with Preselector: Typically < –70 dBm over recommended operating ranges with Spectrum Analyzer input attenuator set to 0 dB. (See Table 3-1.)

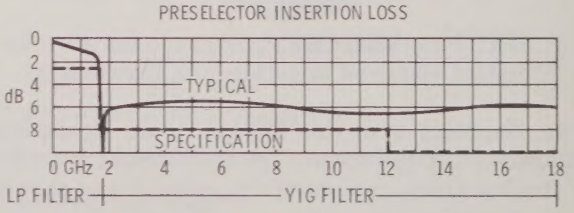
Remote Function: YIG filter frequency can be set by externally supplied voltage. Differential input utilized to eliminate ac hum or other common mode signals which may be present on remote drive input cable.

Sensitivity: Nominally +1 volt/GHz (with direction of tuning from low to high frequency).

Settling Time: Typically within 3 MHz of final frequency after 5ms.

Remote Input Connector: BNC female, outer conductor isolated.

Typical Insertion Loss: The following chart shows typical versus specification values of insertion loss. (The typical curve is developed from eleven spot checks. See paragraph 5-15.)



the information, cautions, and warnings in this manual must be followed to ensure safe operation and to keep the instrument safe. Service and adjustments should be performed only by qualified service personnel.

1-16. Adjustment or repair of the opened instrument with the ac power connected should be avoided as much as possible and, when inevitable, should be performed only by a skilled person who knows the hazard involved.

1-17. Make sure only fuses of the required current rating and type (normal blow, time delay, etc.) are used for replacement. Do not use repaired fuses or short circuit the fuse holders.

1-18. Whenever it is likely that the protection has been impaired, make the instrument inoperative and secure it against any unintended operation.

WARNING

If this instrument is to be energized through an autotransformer (for line voltage variation), make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THE INSTRUMENT, the protective earth terminals of the instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with protective earth contct. The protection must not be negated by using an extension cord (power cable) without a protective grounding conductor.

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal is likely to make this instrument dangerous. Intentional interruption of the earth ground is prohibited.

Servicing this instrument often requires that you work with the instrument's protective covers removed and with ac power connected. Be very careful; the energy at many points in the instrument may, if contacted, cause personal injury.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the instrument's ac input is set to the voltage of the ac power source.

BEFORE SWITCHING ON THIS INSTRUMENT, make sure that all devices connected to the instrument are connected to the protective earth ground.

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the ac line fuse is of the required current rating and type (normal-blow, slow-blow, etc.)

1-19. INSTRUMENTS COVERED BY MANUAL

1-20. Attached to the instrument is a serial number plate (Figure 1-2). The serial number is in two parts. The first four digits and the letter are the serial number prefix; the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-21. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains "change information" which tells you how to adapt the manual to the newer instrument.

1-22. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with this manual's print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-23. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

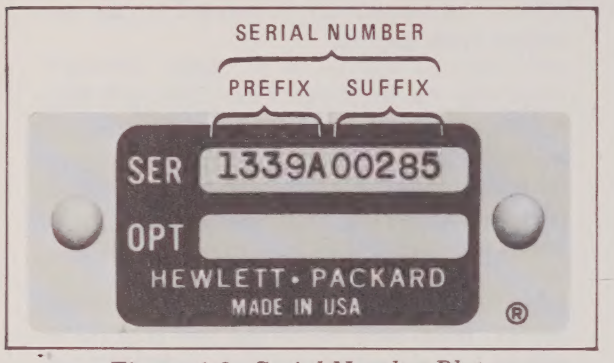


Figure 1-2. Serial Number Plate

1-24. Option 003 Instruments Only

1-25. When an 8445B, Option 003 instrument is ordered (see paragraph 1-33), this manual, an Option 003 Supplement, and an A7 Digital Panel Meter (HP Model 34740A) manual are shipped with the instrument.

1-26. This manual provides necessary references to either the supplement or the A7 DPM Assembly (34740A) manual. The supplement includes partial schematics, tables, and explanations of interconnections and/or modifications made to the Digital Panel Meter which make it compatible to the 8445B.

1-27. DESCRIPTION

1-28. The Model 8445B Automatic Tracking Preselector is designed to complement the Model 8555A Spectrum Analyzer RF Section. The Standard Preselector covers the frequency range of dc to 18 GHz. When used with the 8555A Spectrum Analyzer, the Preselector functions to reduce or eliminate signal intermodulation, in addition to multiple and spurious responses. The Standard Preselector has a fixed frequency low-pass filter for the dc to 1.8 GHz frequency range, and a voltage tuned filter, using a YIG (yttrium-iron-garnet) crystal as a resonant tuning circuit in the RF signal path for the frequency range of 1.8 to 18 GHz. When used with the 8555A/8552/140 Spectrum Analyzer system, the YIG filter is a swept selective filter that tracks the frequency of the analyzer as the analyzer sweeps across its selected range. The YIG filter is electronically tuned by sweep voltage and band code signals from the analyzer. In addition to its primary function as a Preselector, the YIG filter may be used as a manually or electronically tuned bandpass filter. The YIG filter may be tuned by external sweep voltage or manually tuned by front panel controls (Option 002). A Digital Panel Meter (Option 003) normally indicates the Spectrum Analyzer center frequency. In remote or manual modes, the indicated frequency is that to which the YIG filter is tuned.

1-29. OPTIONS

1-30. The Standard 8445B. An Automatic Preselector consisting of a YIG-tuned tracking filter operating between 1.8 and 18 GHz, and a dc to 1.8 GHz low-pass filter. The input and output ports of the instrument are Type N coaxial connectors. Included is an HP 11670L rigid coaxial cable for connection of the 8445B output to an 8555A spectrum analyzer when the preselector is mounted above the 8555A with a joining bracket kit. For other mounting configurations, order 8445B Option 005 to delete the 11670L. Then select the appropriate cable indicated in Table 1-4.

1-31. Option 001. The standard Type N input and output port connectors are replaced by Precision APC-7 connectors. An HP 11670M interconnect cable (with APC-7 connectors) is included in place of the HP Number 11670L cable. An 8445B Option 001 must be used with an 8555A Option 001 which has an APC-7 RF Input connector. (An APC-7 terminated RF interconnect cable can be ordered from Table 1-4. Order Option 005 to delete the standard Type N interconnect cable.)

1-32. Option 002. A front panel MODE switch and two MANUAL TUNE controls are added to the Automatic Preselector to provide selection of manual tuning, automatic tuning, and remote tuning of the YIG-tuned filter, or substitution of a 1.8 MHz low-pass input filter.

1-33. Option 003. A digital readout of the center frequency of the spectrum analyzer is displayed by a digital panel meter (DPM) on the front panel of the preselector. The DPM indictes the frequency of the YIG-tuned filter when voltage fed to the REMOTE input BNC connector is used to control the YIG.

1-34. Option 004. The 1.8 GHz low-pass filter is deleted.

1-35. Option 005. The HP 11670L rigid RF Interconnect cable is deleted.

1-36. Option 100. Includes a modification kit for certain Model 140 mainframes (see Paragraph 2-22 and Table 2-2) to make these displays compatible

with the 8445B. It adds an Auxilliary B output jack to the display mainframe.

1-37. Option 200. Includes a modification kit for certain Model 140 mainframes (see Paragraph 2-22 and Table 2-2) to make these displays compatible with the 8445B. It adds Auxilliary A and B output jacks to the display mainframe.

1-38. ACCESSORIES SUPPLIED

1-39. Table 1-3 lists the accessories supplied with the Preselector. The accessories supplied are for a standard installation which provides for the Preselector to be mounted on an 8555A Spectrum Analyzer and fastened with a joining racket kit. A different mounting installation will require a different RF cable to connect between the Preselector output and the Spectrum Analyzer input (Figure 1-3). The power cable supplied with the instrument is selected at time of shipment. Selection is based on shipping destination. Figure 2-2 illustrates the different power cable connectors that are currently available.

1-40. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-41. The Automatic Preselector is intended for use with the 8555A Spectrum Analyzer System. This includes an 8555A RF Section, an 8552 series IF Section, and a 140 or 141 series Display Section.

1-42. EQUIPMENT AVAILABLE

1-43. The rigid RF Interconnect cable used to couple a Preselector to a Spectrum Analyzer is illustrated in Figure 1-3. Standard Preselectors are made to operate above the Spectrum Analyzer. The possible mounting configurations, connector types, dimensions and part numbers are indicated in Table 1-4. For information regarding RF Interconnect cables used when the Preselector is mounted BELOW the Spectrum Analyzer, contact your local Hewlett-Packard Sales Office.

Table 1-3. Accessories Supplied

HP Part Number	Name	Description
*	Line Power Cable	7 - 1/2 feet, 3-wire Ac, Line Cord
11670L**	RF Interconnect Cable	Rigid Coaxial Cable. Connects Preselector RF output to Spectrum Analyzer RF Input. Type N connectors.
08445-60007	Interconnect Cable	20-inch Control Cable, interconnects Preselector with Spectrum Analyzer.
2110-0012	Fuse	0.5A — 220/240 Vac
5060-8739	Rack Mounting Kit	Hardware and parts for mounting Preselector in 19-inch rack.
5060-8543	Joining Bracket Kit	Hardware and parts for strapping Preselector to Spectrum Analyzer.

*See paragraph 2-10 and Figure 2-2.

**See paragraph 1-35 and Figure 1-3; item not supplied with Option 005.

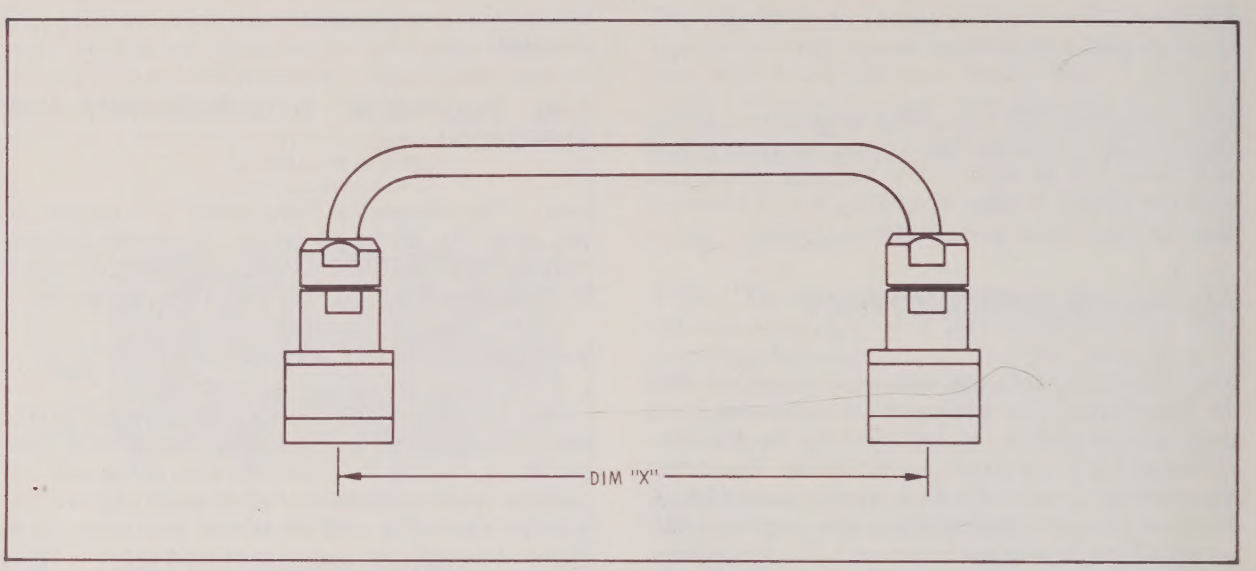


Figure 1-3. RF Interconnect Cable

Table 1-4. RF Interconnect Cable Information

Preselector Analyzer	Connector Type	Dimension of "X", Figure 1-3		HP Part Number
		Inches	Cm	
With feet on Preselector	N	4.72	11.99	11670C
With feet on Preselector	APC-7	4.72	11.99	11670D
Rack Mounted	N	4.58	11.63	11670G
Rack Mounted	APC-7	4.58	11.63	11670H
With Joining Bracket Kit	N	4.36	11.07	11670L*
With Joining Bracket Kit	APC-7	4.36	11.07	11670M**

*Cable supplied with kit — except when Option 005 ordered.
**Cable supplied with Option 001 instruments.

1-44. WARRANTY

1-45. The 8445B Automatic Preselector is warranted and certified as indicated on the inner front cover of this manual and in Appendix A. For further information, contact the nearest Hewlett-Packard office; addresses are provided on the last page and rear cover of this manual.

1-46. RECOMMENDED TEST EQUIPMENT

1-47. Table 1-5 lists the test equipment and accessories required to check, adjust and repair the Preselector. If substitute equipment is used it must meet the Minimum Specifications listed.

Table 1-5. Test Equipment and Accessories (1 of 2)

Item	Minumum Specifications	Suggested Model	Use*
Frequency Comb Generator	Frequency markers spaced 1, 10, 100 MHz apart; usable to 8 GHz Frequency Accuracy: ±0.01% Output Amplitude: > −40 dBm to 2 GHz	HP 8406A Comb Generator	A,T
Signal Generator	Frequency Range: 1.8 — 4.0 GHz Frequency Accuracy: ±1% Output Amplitude: > +5 dBm Output Impedance: 50 ohms	HP 8616A Signal Generator	P,A
Sweep Oscillator	Frequency Range: 2.0 — 18 GHz Output Amplitude: > −5 dBm Output Impedance: 50 ohms	HP 8620A Sweep Oscillator with 86290A RF Unit	P,A
Digital Voltmeter	Voltage Accuracy: ±0.01% of reading +0.01% of range Resolution: ±1 mV @ 10 volts Overrange: 50% Input Impedance: 10 megohms	HP 3480B Digital Multimeter with HP 3484A Multi-Function Unit	A,T
Oscilloscope	Frequency Range: DC to 50 MHz Time Base: 1 μs/div to 10 ms/div Time Base Accuracy: ±3% Dual Channel, Alternate Operation Ac or dc Coupling External Sweep Mode Voltage Accuracy: ±3% Sensitivity: 0.005 V/div	HP 180A with HP 1801A Vertical Amplifier and HP 1821A Horizontal Amplifier HP 10004 10:1 Divider Probes (2)	T
Power Meter	Frequency Range: 0.01 — 18.0 GHz Accuracy: ±1% Power Range: −20 to +10 dBm	HP 435A Power Meter with HP 8481A Power Sensor	P
Power Supply Dual Dc	Output Voltage: Variable, 0 — 20 Vdc Output Current: 0 — 300 mA Meter Accuracy: 3% Control: Fine adjustment	HP 6205B Power Supply	P,A,T
Dc Volt-ohm-Ammeter	Voltmeter Voltage Range: 1 mV — 300 V Accuracy: ±1% Input Resistance: 10 megohms Ammeter Current Range: 1 μA — 1A Accuracy: ±2% Ohmmeter Resistance range: 1 ohm — 100 megohm Accuracy: ±5% reading at center scale	HP 412A Volt-Ohm-Ammeter	T

*A = Adjustments; T = Troubleshooting; P = Performance

Table 1-5. Test Equipment and Accessories (2 of 2)

Item	Minumum Specifications	Suggested Model	Use*
Spectrum Analyzer	Frequency Range: 0.01 — 18 GHz Frequency Response: < ±2.0 dB	HP 8555A Spectrum Analyzer with HP 8552 IF Section and HP 141T Display Section	P, A, T
AC Voltmeter	Voltage Accuracy: ±2% of full scale Voltage Range: 300 Vac full scale Input Impedance: 10 megohms	HP 427A Multifunction Voltmeter	A
Variable Voltage Transformer	Voltage Range: 102 — 127 Vac	General Radio W5MT3A or Superior Electric UC1M	A
Coaxial Cable	Male BNC Connectors, 44 inches long with alligator clips	HP 10501A Cable Assy w/alligator clips	P,A
Frequency Meter	Frequency Range: 2 — 18 GHz Overall Accuracy: 0.2%	HP 536A/537A/P532A Frequency Meters	A
Swept Frequency Indicator	Sensitivity: 5 dB/div Blanking: 0 — 5 V gate Vertical Input Impedance: 75K ohms	HP 8755A Swept Amplitude Analyzer 180D, Option 807 Display, 11664A Detector 11665A Modulator	A
6 dB Coaxial Attenuator	Frequency Range: Dc — 18 GHz	HP 8491B Coaxial Attenuator, Option 006	A
10 dB Coaxial Attenuator	Frequency Range: Dc — 18 GHz	HP 8491B Coaxial Attenuator, Option 010	A
Adapter	APC-7 to Type N male	HP 11525A	A
Clip-on Milliammeter	Dc Current Range 1mA — 10A Accuracy ±3% of full scale	HP 428B	T

*A = Adjustments; T = Troubleshooting; P = Performance

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section includes information on the initial inspection, preparation for use, and storage/shipment instructions for the HP Model 8445B.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. The Model 8445B requires a power source of 100, 120, 220, or 240 Vac +5% −10%, 48 to 440 Hz single phase. (440 Hz operation requires a special H16 440-Hz fan modification. Contact your nearest H P representative.) Power consumption is less than 110 volt-amperes.

2-8. Line Voltage and Fuse Selection

2-9. Select the line voltage and fuse as follows:

a. Measure the ac line voltage and fuse as follows:

b. Refer to Figure 2-1. At the instrument's rear panel power line module, select the

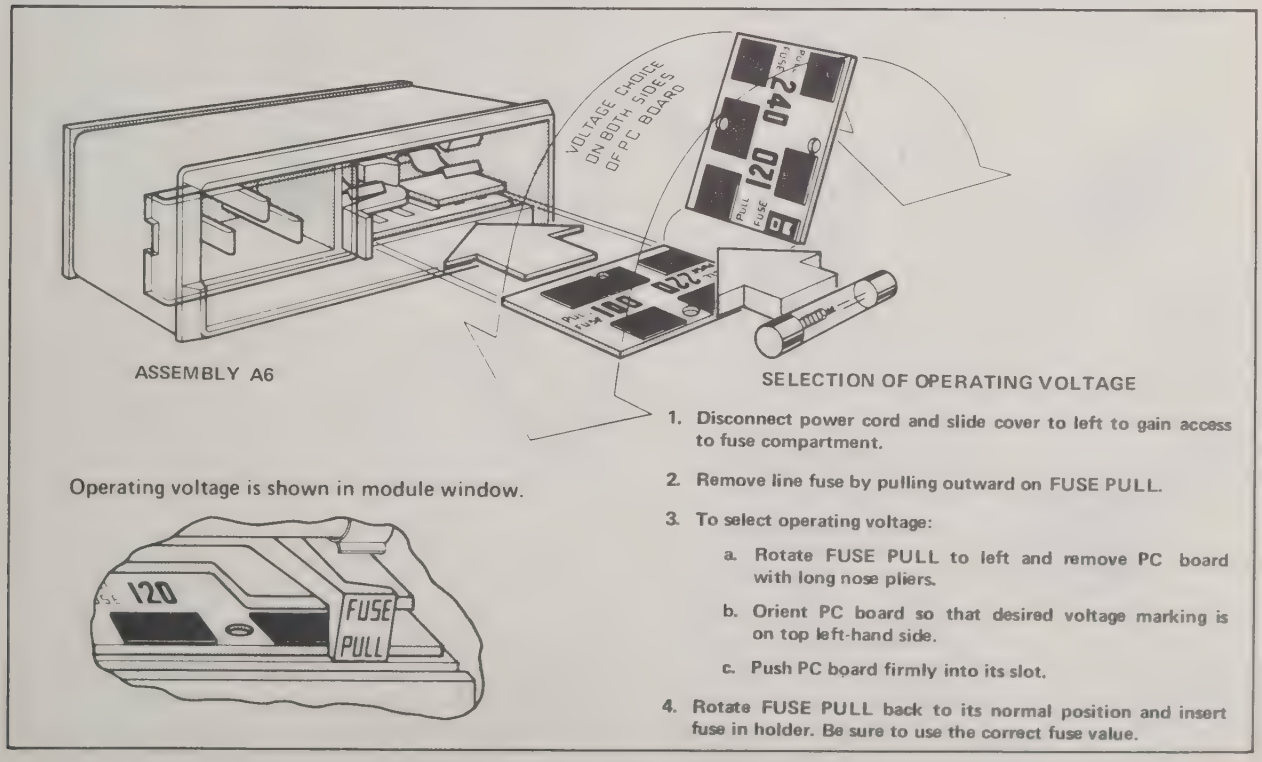

VOLTAGE CHOICE ON BOTH SIDES OF PC BOARD
240
120
FUSE PULL
ASSEMBLY A6
SELECTION OF OPERATING VOLTAGE
1. Disconnect power cord and slide cover to left to gain access to fuse compartment.
2. Remove line fuse by pulling outward on FUSE PULL.
3. To select operating voltage:
a. Rotate FUSE PULL to left and remove PC board with long nose pliers.
b. Orient PC board so that desired voltage marking is on top left-hand side.
c. Push PC board firmly into its slot.
4. Rotate FUSE PULL back to its normal position and insert fuse in holder. Be sure to use the correct fuse value.
Operating voltage is shown in module window.
120
FUSE
PULL

Figure 2-1. Line Voltage Selection

line voltage (100 V, 120 V, 220 V, or 240 V) closest to the voltage you measured in step a. Line voltage must be within +5% or −10% of the voltage setting.

c. Make sure the correct fuse is installed in the fuse holder. The required fuse rating for each line voltage selection is indicated at the power module.

d. Connect the ac power cord to the instrument ac power receptacle.

2-10. Power Cable

2-11. In accordance with international safety standards this instrument is equipped with a three-wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. Figure 2-2 shows the styles of mains plugs available on power cables supplied with HP instruments. The numbers under the plugs are part numbers for complete power cables.

WARNING

The protection provided by grounding the instrument cabinet may be lost if any power cable other than the 3-pronged type is used to couple the ac line voltage to the instrument.

Figure 2-2. Power Cable HP Part Numbers Versus Mains Plugs Available

2-12. Mating Connectors

2-13. A list of possible connectors on the front and rear panels of the Model 8445B is given in Table 2-1.

2-14. Operating Environment

2-15. The operating environment should be within the following limitations:

Temperature ..... 0 to 55° C
Humidity ..... <95% relative
Altitude ..... <15,000 feet

2-16. A forced-air cooling system is used to maintain required operating temperatures within the instrument. The air intake and filter are located on the rear of the instrument; warm air is exhausted through the side panel perforations. When operating the instrument, choose a location which provides at least three inches of clearance around the rear and sides.

2-17. Installation Instructions

2-18. When used with the Spectrum Analyzer, the Preselector should be both mechanically and electrically connected to the Spectrum Analyzer. The preferred mounting configuration is with the Preselector mounted on top of and secured to the Spectrum Analyzer. A joining bracket kit is supplied to secure the Preselector to the analyzer. A rigid coaxial cable (for the preferred mounting configuration) is supplied to connect the OUTPUT on the Preselector to the INPUT connector of the Spectrum Analyzer. For mounting installations other than the preferred configuration refer to Figure 1-3 for cable information.

2-19. Bench Operation

2-20. The instrument cabinet has plastic feet and a foldaway tilt stand for convenience in bench operation. The tilt stand raises the front of the instrument for easier viewing of the control panel, and the plastic feet are shaped to make full-width modular instruments self-aligning when stacked.

2-21. Rack Mounting

2-22. This instrument is supplied with a rack mounting kit. This rack mounting kit contains all the necessary hardware and installation instructions for preparing the instrument to be mounted on a rack of 19-inch spacing. Installation instructions are given in Figure 2-3.

Table 2-1. Model 8445B Mating Connectors

Connector	Industry Identification	HP Part No.	Alternate Sources
J1 INPUT	Type N, male connector, UG-21G/U	1250-0882	Amphenol Bendix Specialty Connector
	(Option 001) Type APC-7 connector	1250-1183	Amphenol
J2 OUTPUT	Type N, male connector, UG-21G/U	1250-0882	Amphenol Bendix Specialty Connector
	(Option 001) Type APC-7 connector	1250-1183	Amphenol
J4 REMOTE input	Type BNC, male connector, UG-88/U	1250-0256	Amphenol Bendix Specialty Connector
J5 Interconnect cable connector	R & P Series, 17 contact, female connector	1250-1286	Cannon Cinch

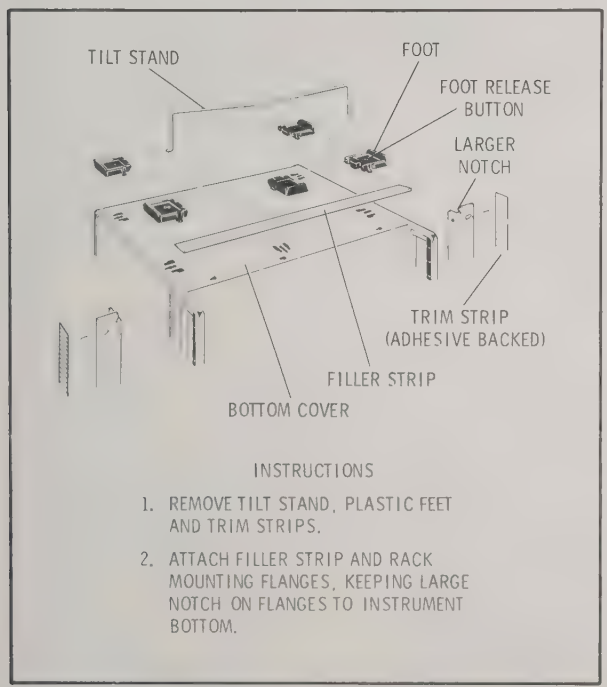

TILT STAND
FOOT
FOOT RELEASE BUTTON
LARGER NOTCH
TRIM STRIP (ADHESIVE BACKED)
FILLER STRIP
BOTTOM COVER
INSTRUCTIONS
1. REMOVE TILT STAND, PLASTIC FEET AND TRIM STRIPS.
2. ATTACH FILLER STRIP AND RACK MOUNTING FLANGES, KEEPING LARGE NOTCH ON FLANGES TO INSTRUMENT BOTTOM.

Figure 2-3. Preparation for Rack Mounting

2-23. MODIFICATIONS REQUIRED

2-24. Display Sections

2-25. HP Model 140T Display Sections with serial prefix 1105A and below, HP Model 141T Display Sections with serial prefix 1047A and below, all HP Model 140S/141S Display Sections and all HP Model 140-series Oscilloscope Mainframes require modification for Preselector compatibility (Refer to Table 2-2.) The modification consists of adding a cable assembly to the Display Section. This cable connects between the Auxilliary "B" output connector on the rear panel of the 8555A RF Section and the rear panel of the Display Section.

2-26. 8555A RF Section

2-27. Spectrum Analyzer RF Sections with Serial Prefixes 1232A and below must be modified per Service Note 8555A-1 for compatibility with 8445B Option 003 instruments. (See Appendix B.)

2-28. STORAGE AND SHIPMENT

2-29. Environment

2-30. The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature ..... −40 to +75° C
Humidity ..... <95% relative
Altitude ..... <25,000 feet

2-31. Packaging

2-32. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-33. Other Packaging. The following general instructions should be used for repackaging with commercially available materials:

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequte.

c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

Table 2-2. Modification of Display Sections for Preselector Compatibility

Modification Kit HP Part Number	DISPLAY SECTION	
	HP Model Number	Serial Prefix
00140-69505*	140T	1105A and below
	141T	1047A and below
	140S/141S (Option TG-1)	All
00140-69504**	140S/141S (Except Option TG-1 Instruments)	All

*Included with 8445B Option 001.
**Included with 8445B Option 002.

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section describes the HP 8445B Automatic Preselector operation with an HP 8555A/8552/140 Spectrum Analyzer system. It describes front and rear panel controls and connectors, and outlines operation of the system.

3-3. SPECTRUM ANALYZER PRESELECTION

3-4. The 8555A Spectrum Analyzer RF Section has a 2.01 — 4.4 GHz YIG-tuned first local oscillator (LO), and selects either a 550 or 2050 MHz first IF, depending on the frequency band in use. The untuned input circuitry of the 8555A accepts any signals from 10 MHz to over 18 GHz. These signals are mixed with the first LO as well as with harmonics of the LO. In some cases this presents problems interpreting several signals being displayed. The preselector is used to eliminate unwanted responses on the CRT display. The standard Preselector uses a low-pass filter for the frequency range of dc to 1.8 GHz, and a YIG resonator as a nominal 30 MHz bandwidth tunable microwave filter capable of operating over the frequency range of 1.8 — 18 GHz. The driving voltage used to tune the YIG first LO in the 8555A is modified and used to tune the YIG filter in the Preselector. By tracking the Preselector with the Spectrum Analyzer tuning, virtually all image, multiple, and spurious responses can be eliminated from the display.

CAUTION

Installation of a coaxial attenuator or a coaxial isolator at the Preselector INPUT is recommended when operating with signal sources that are not capable of absorbing their own reflected power. Any signals outside the passband of the Preselector input will be reflected back to the source.

3-5. Multiple responses occur when the local oscillator harmonics cause more than one display for a single input frequency. For example, when a 9.5 GHz signal is fed to the analyzer RF INPUT, responses due to the 5^-, 3^+, 4^-, 2^+, and 3^- appear on the display (see Figure 3-1). Follow the signal frequency line for 9.5 GHz across the figure noting the intersections with solid lines representing mixing modes. The Preselector tracks the selected mixing mode so that responses from other mixing modes are not present on the display.

3-6. When the analyzer first LO is tuned to 3 GHz (2050 MHz 1st IF), image responses may occur at different frequencies. (Refer to Figure 3-1.) Following the 3 GHz local oscillator line up the figure, note intersections with solid lines representing mixing modes. Each of these signals will appear at the same place on the CRT, although products of different mixing modes. The Preselector eliminates images by allowing only selected frequency band signals to enter the analyzer's RF INPUT, and allowing only one mixing mode to be used at one time.

3-7. Spurious signal responses are caused when strong signals enter the RF INPUT of the analyzer, and are of sufficient amplitude to cause intermodulation products. The narrow bandwidth of the Preselector YIG filter (30 MHz nominal) acts to eliminate spurious signal responses on the display. Input signals that are farther apart than the Preselector filter bandwidth cannot appear in the analyzer input at the same time.

3-8. RECOMMENDED MIXING MODES

3-9. Table 3-1 lists the frequency ranges that the Preselector will track when operating with an 8555A Spectrum Analyzer. It indicates signal frequencies from 0.01-18 GHz and the recommended 8555A frequency bands to be used for them. Analyzer responses, tracked by the Preselector, overlap at the edges of different frequency bands. Note the intersection of the n=3− tuning curves at 4.1 GHz in Figure 3-1. Signals near the intersection points can appear in the passband of the Preselector from both of these mixing modes.

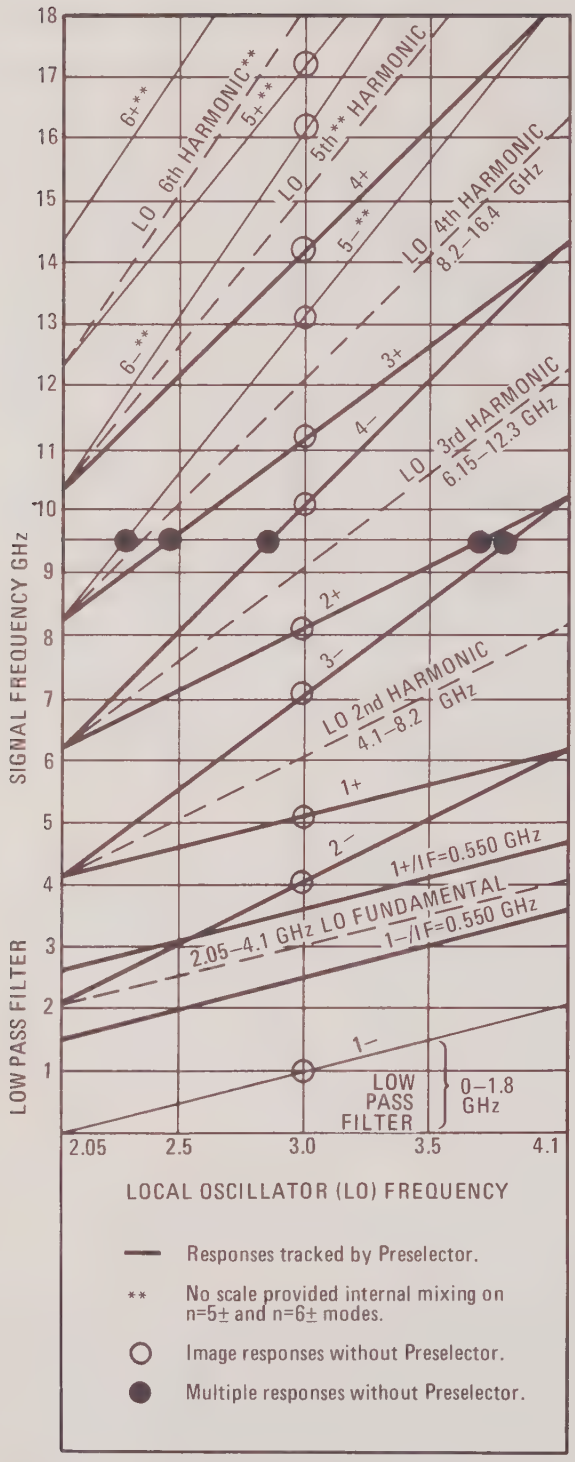


Figure 3-1. Spectrum Analyzer Tuning Curves and Responses

3-10. PRESELECTOR TRACKING

3-11. The Preselector tracking with the Spectrum Analyzer is governed by the linearity of the 8555A's YIG Drive sweep voltage versus the first LO frequency. Preselector tracking in both REMOTE and MANUAL operating modes is affected by the front panel FREQ OFFSET and TRACKING controls. Adjustment of these controls changes the accuracy of the +1 V/GHz remote tuning and the dial accuracy of the manual controls. To adjust FREQ OFFSET and TRACKING controls for correct REMOTE or MANUAL operation, perform the YIG DRIVER ADJUSTMENTS in Section V of this manual.

3-12. PRESELECTOR BANDWIDTH

3-13. The YIG filter has a 3 dB bandwidth that is typically 20 to 45 MHz depending on the portion of the frequency spectrum in which it is being used. Figure 3-2 illustrates a typical 3-dB YIG filter passband display at 4 GHz, using a 10 MHz/Div analyzer sweep. The Preselector is fixed-tuned to 4 GHz. The input signal is tuned through the passband.

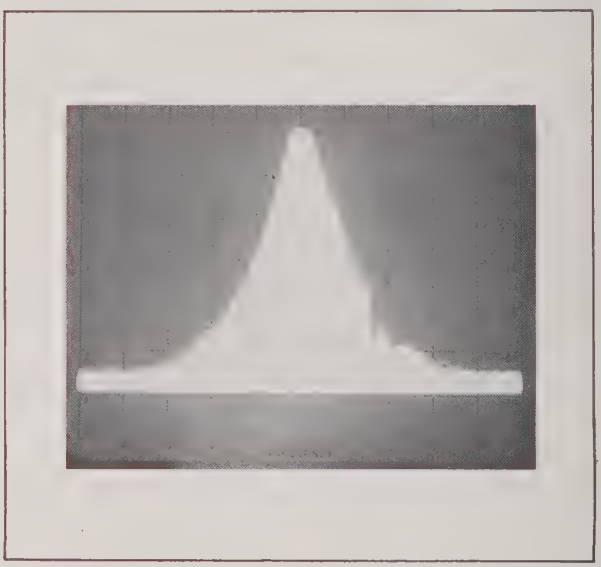


Figure 3-2. Typical 3-dB Yig Filter Passband Display at 4 GHz and with a 10 MHz/DIV sweep.

3-14. PANEL FEATURES

3-15. Front and rear panel features of the Standard, Option 002, and Option 003 8445B Automatic Preselectors are described in Figure 3-3. Front and rear panel views of a Preselector connected to the HP 8555A/8552/141T Spectrum Analyzer are shown in Figures 3-4 and 3-5. For a detailed description of the Spectrum Analyzer controls and indicators refer to the appropriate operating and service manuals for those instruments. Interconnection wiring between the Preselector and the Spectrum Analyzer is contained in Section VIII of this manual.

Table 3-1. 8555A Frequency Ranges and Recommended Mixing Modes

Signal Frequency GHz	Recommended Mixing Modes (n)	Analyzer Frequency Range GHz
0.01 — 1.8	1−	0.01 — 2.05
1.8 — 3.5	1−*	1.50 — 3.55
2.8 — 4.5	1+*	2.60 — 4.65
2.8 — 5.5	2−	2.07 — 6.15
4.3 — 5.8	1+	4.11 — 6.15
4.9 — 9.0	3−	4.13 — 10.25
6.6 — 9.5	2+	6.17 — 10.25
7.3 — 13.0	4−	6.19 — 14.35
9.0 — 13.3	3+	8.23 — 14.35
11.0 — 18.0	4+	10.29 — 18.00

* Indicates .550 GHz IF. 2.05 GHz IF used on other bands.

3-16. OPERATOR'S CHECKS

3-17. Upon receipt of the instrument, or whenever the Preselector is to be used with a different analyzer, perform the Operator's Checks listed in Figures 3-4 and 3-5. These procedures correct for minor tracking differences between Preselector and Spectrum Analyzer.

3-18. OPERATING INSTRUCTIONS

3-19. General operating instructions are contained in Figure 3-3. These instructions will familiarize the operator with basic operating functions of the Preselector with the Spectrum Analyzer. Additional operating techniques and information are contained in Figures 3-4 and 3-5.

3-20. OPERATOR'S MAINTENANCE

3-21. Operator's Maintenance involves changing or replacing fuses, cleaning the air filter, and replacing a defective LINE switch lamp. Removing the air filter requires use of a Pozidriv screwdriver; all other operations do not require tools.

3-22. Fuses

3-23. The primary power fuse is found within the A6 Power Module assembly on the rear panel of the 8445B. A fuse change may be necessary when the instrument is moved to a location with a different ac line voltage or when the fuse has burned out. Steps one and three of Figure 2-1 show how the fuse is changed or replaced. Power Module fuse A6F1, as well as internal A2 and A3 assembly fuse information is found in Section VI.

3-24. Air Filter

3-25. The air filter should be removed and cleaned periodically. It is recommended that it be checked every three months and, if necessary, washed in warm water and detergent. After washing allow the filter to dry for a few minutes before reinstallation.

3-26. Fan

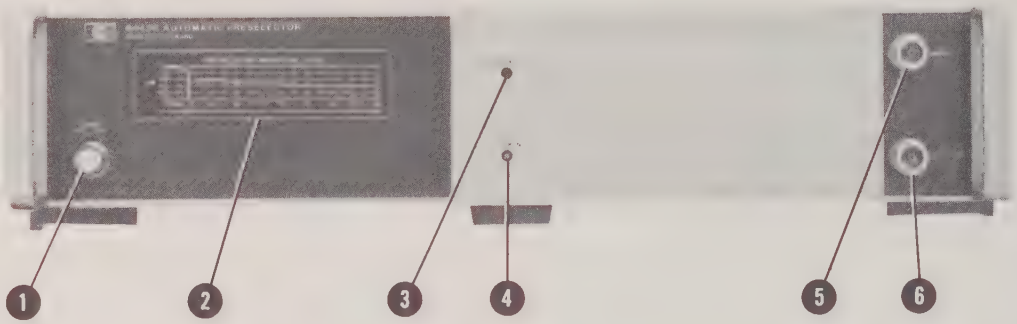
3-27. The fan in this instrument is a self-lubricating unit and does not require maintenance.

3-28. Lamp Replacement

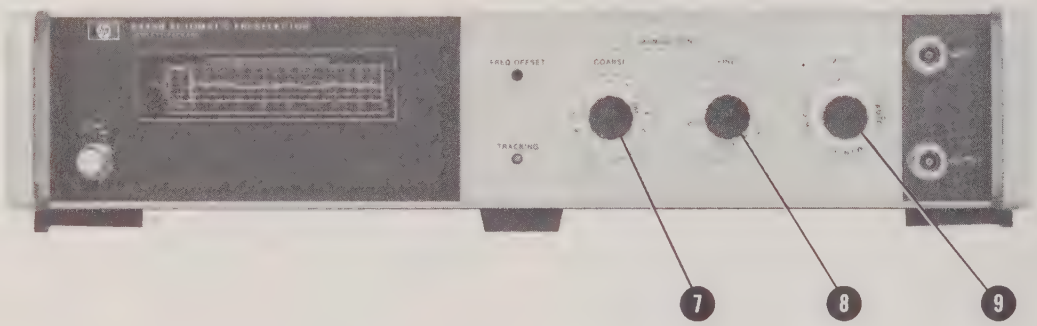
3-29. The lamp is contained in the white plastic lens which doubles as a pushbutton for the LINE switch. When the switch is ON, the lamp should be illuminated. Figure 3-6 illustrates how to remove and install the lamp. The lamp, DS1, may be ordered under HP part number 2140-0244.

8445B FRONT PANEL FEATURES

STANDARD PRESELECTOR



PRESELECTOR WITH OPTION 002



PRESELECTOR WITH OPTION 003

Figure 3-3. 8445B Controls, Connectors and Indicators (1 of 3)

8445B FRONT PANEL FEATURES

1. **LINE — ON/OFF.** Controls primary power. Light glows when switch is energized. Type A1H bulb.

2. **PRESELECTOR INSERTION LOSS Chart.** Indicates insertion loss versus frequency. Calibration chart extrapolated from point-to-point measurements of YIG filter insertion loss. FREQ OFFSET control adjusted for minimum insertion loss at each test point. During power level measurement, Spectrum Analyzer LOG REF LEVEL Vernier control may be adjusted to compensate for the indicated insertion loss.

3. **FREQ OFFSET.** Adjusts YIG driver to compensate for offset in YIG filter tuning due to residual magnetism in core structure. Adjusted to center the YIG filter at 2.0 GHz for wide range tracking. Adjusted for minimum filter insertion loss during power level measurements. (See Figure 3-5).

4. **TRACKING.** Adjusts YIG driver gain to match linear current-frequency curve of YIG filter. Adjusted during opertional adjustments at a frequency of 8 GHz. Adjustment required to match tuning of Preselector with tuning of Spectrum Analyzer. Interacts with FREQ OFFSET adjustment. (See Figure 3-5).

5. **INPUT.** Type N coaxial connector normally provided. Option 001 instruments supplied with APC-7 connectors.

6. **OUTPUT.** Type N coaxial connector normally provided. Option 001 instruments supplied with APC-7 connector. See Table 1-3 for optional rigid coaxial interonnect cables.

7. **MANUAL TUNE COARSE — Option 002 Instruments.** Manual YIG filter frequency tune control. Sets YIG filter center frequency in manual operating mode.

8. **MANUAL TUNE FINE — Option 002 Instruments.** Fine tune control for YIG filter frequency in manual operating mode.

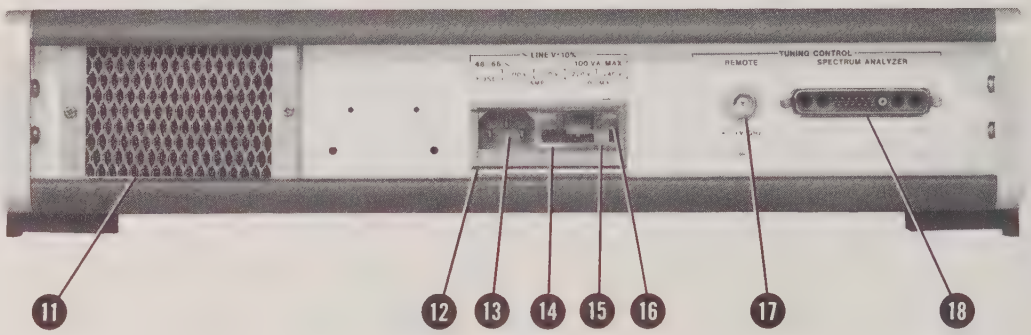
9. **MODE — Option 002 Instruments.** Selects Preselector mode of operation. MANUAL — YIG filter tuned by front panel controls. AUTO — Low-pass filter and/or YIG filter selected by control signals from analyzer RF Section. YIG frequency tuned by signal from RF Section. REMOTE — YIG filter tuned by input voltage to BNC connector on rear panel. LOW-PASS (except Option 004) — Selects 1.8 GHz low-pass filter. Inhibits Spectrum Analyzer control of Preselector.

10. **DIGITAL PANEL METER Frequency Readout — Option 003 Instruments.**

Indicates center frequency of the YIG filter passband in Manual or Remote Mode. In AUTOMATIC Mode, indicates center frequency of 8555A Spectrum Analyzer, reads zero above 18 GHz or in LOW-PASS Mode.

Figure 3-3. 8445B Controls, Connectors and Indicators (2 of 3)

8445B REAR PANEL FEATURES



11 Air Intake. Maintain at least 3-inch clearance from surrounding objects.

12 Power Module Assembly. 100, 120, 220 and 240 Vac +5%, −10%; 48 to 440 Hz 100 VA max.

13 Line Input. Connects to external ac power supply.

14 Line Voltage Selector Card. Printed circuit board used to match the available line voltage to the transformer primary.

15 Fuse extractor and selector Lock. Prevents line voltage selector card from being removed until fuse is extracted.

16 Line Input Fuse. Rating of fuse to be used is marked on rear panel near the Power Module Assembly.

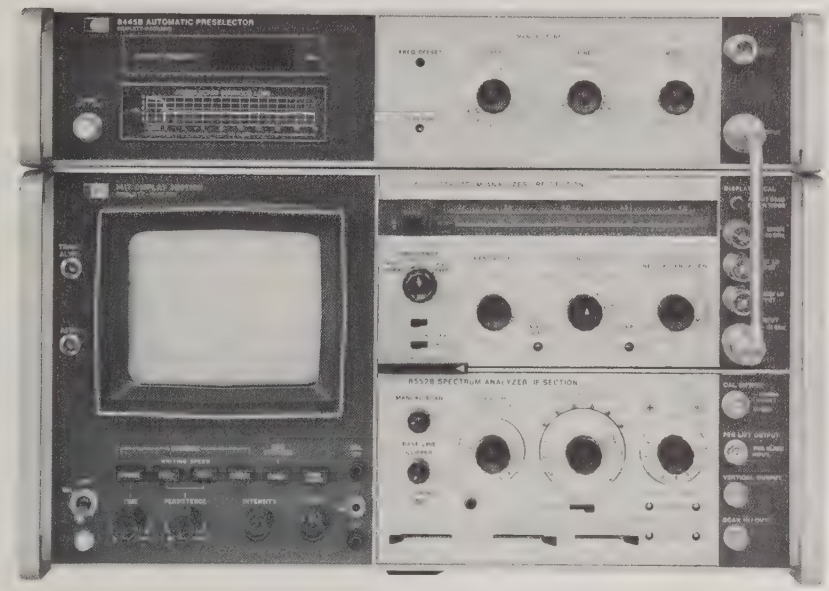
17 TUNING CONTROL — REMOTE. Input for remote tuning voltage to YIG filter. Enabled when Spectrum Analyzer is not operating (power off), when interconnect cable is disconnected or (on Option 002) when the mode switch is set to REMOTE. Type BNC connector. YIG filter frequency to voltage ratio: 1.0 GHz/Volt.

18 TUNING CONTROL — SPECTRUM ANALYZER Input. Input control voltage (for selection of YIG or low-pass filter), YIG tuning voltage, and band code information. Disconnect input cable when using REMOTE input to tune YIG filter.

Figure 3-3. 8445B Controls, Connectors and Indicators (3 of 3)

OPERATOR'S CHECKS
USING LOW PASS FILTER

FRONT VIEW



REAR VIEW

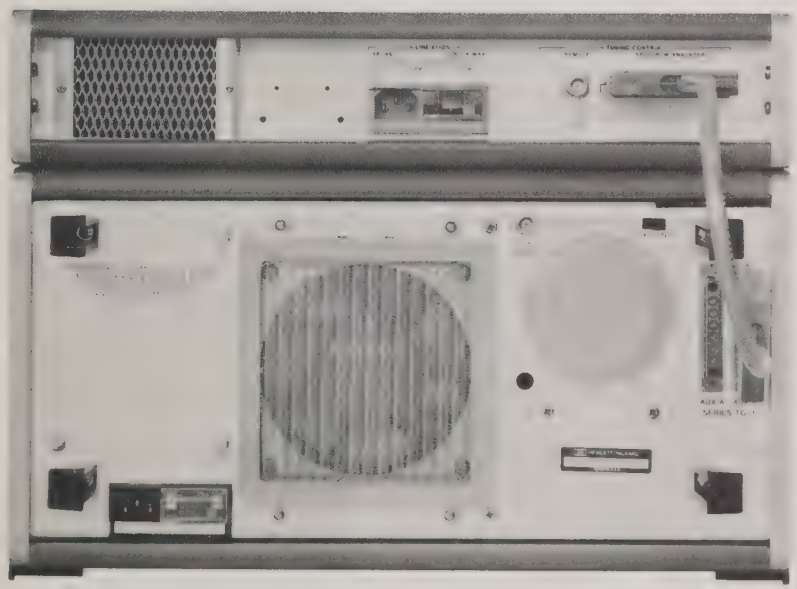


Figure 3-4. Low-Pass Filter Operation, 10 MHz to 1.8 GHz (1 of 3)

OPERATOR'S CHECKS USING LOW PASS FILTER

1. Check that the Line Voltage Selection Card is positioned to correspond to the available line voltage. Refer to the information on Line Voltage Selection in Section II.

2. Connect interconnect cable beween AUX B output on Spectrum Analyzer Display Section and TUNING CONTROL — SPECTRUM ANALYZER input on Preselector.

3. Connect Preselector and Spectrum Analyzer to line voltage source and apply power.

4. Perform Spectrum Analyzer Operational Adjustments in Section III of Spectrum Analyzer RF Section 8555A Operating and Service Manual.

NOTE

The information below does not apply to Automatic Preselectors with Option 004 which have no low-pass filters. Adjustments for such instruments are outlined in Figure 3-5.

5. Set analyzer LOG/LINEAR switch to LINEAR and rotate LOG REF LEVEL control until 1 mV/DIV is matched with the lighted index lamp.

6. Connect Analyzer CAL OUTPUT to INPUT of Preselector.

7. Connect rigid coaxial cable between Preselector OUTPUT and Analyzer INPUT.

8. Note and record low-pass filter insertion loss at 30 MHz. From 7th graticule line from bottom of CRT to 5th graticule line represents approximately 3 dB. Low-pass filter insertion loss should be <1 dB.
9. Remove rigid coaxial cable connecting Preselector OUTPUT to Analyzer INPUT.

10. Set Analyzer INPUT ATTENUATION to 40 dB.

11. Set Analyzer LOG/LINEAR control to LOG.

12. Rotate LOG REF LEVEL control to (+) 10 dBm.

13. Set SCAN WIDTH PER DIVISION to 10 MHz and set FREQUENCY control to position cursor at 1.5 GHz on frequency scale.

14. With INPUT ATTENUATION at 40 dB, connect Analyzer SECOND LO OUTPUT to INPUT.

15. Center 1.5 GHz LO signal on CRT display. Reduce SCAN WIDTH PER DIVISION to 0.2 MHz, keeping signal centered on CRT with FREQUENCY control.

16. Rotate LOG REF LEVEL control fully counter-clockwise.

17. Set LOG/LINEAR switch to LINEAR and adjust LINEAR SENSITIVITY controls for a 7.1 division display of the 1.5 GHz signal.

Figure 3-4. Low-Pass Filter Operation, 10 MHz to 1.8 GHz (2 of 3)

OPERATOR'S CHECKS
USING LOW PASS FILTER

18. Disconnect cable at Analyzer INPUT and couple to INPUT connector on Preselector.

19. Connect rigid coaxial cable between Preselector OUTPUT and Analyzer INPUT.

20. Note and record low-pass filter insertion loss at 1.5 GHz. From 7th graticule line (from bottom of CRT) to 5th graticule line represents approximately 3 dB. 1.5 GHz low-pass filter insertion loss $\leq$2.5 dB.

21. Set LOG/LINEAR switch to LOG. Set LOG REF LEVEL Vernier control to compensate for the amount of insertion loss indicated in step 20.

22. The Preselector and Analyzer are now calibrated at 1.5 GHz.

23. Remove cable between Preselector INPUT and Analyzer SECOND LO OUTPUT.

24. Install 50 ohm termination on SECOND LO OUTPUT connector.

25. Connect signal (10 MHz to 1.8 GHz) under investigation to INPUT connector of Preselector.

26. Set LOG REF LEVEL vernier control to compensate for insertion loss using data obtained in steps 8 or 20 or the data on the PRESELECTOR INSERTION LOSS chart.

Figure 3-4. Low-Pass Filter Operation, 10 MHz to 1.8 GHz (3 of 3)

OPERATOR'S CHECKS
USING YIG-TUNED FILTER

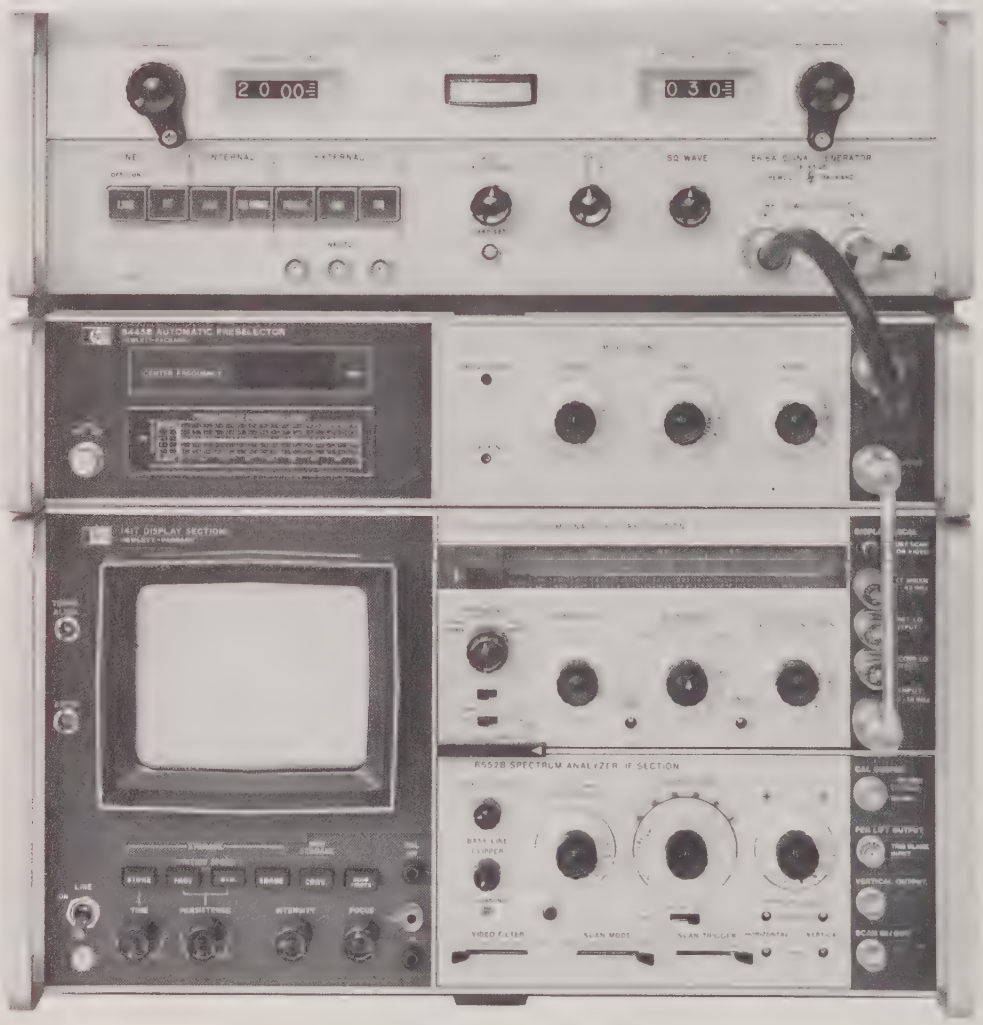


Figure 3-5. 1.8 to 18 GHz YIG-Tuned Filter Operation (1 of 3)

OPERATOR'S CHECKS USING YIG-TUNED FILTER

1. Check that the Line Voltage Selection Card is positioned to correspond to the available line voltage. Refer to information on Line Voltage Selection in Section II.
2. Connect interconnect cable W3 between AUX B output on Spectrum Analyzer Display Section and TUNING CONTROL — SPECTRUM ANALYZER input on Preselector.
3. Connect Preselector and Spectrum Analyzer to line voltage source and apply power.
4. Perform Spectrum Analyzer Operational Adjustments in Section III of Spectrum Analyzer RF Section 8555A Operating and Service Manual.
5. Connect the rigid W1 coaxial cable between Preselector OUTPUT and RF Section INPUT.
6. Set LOG REF LEVEL to 0 dBm.
7. Set SCAN WIDTH PER DIVISION to 10 MHz.
8. Connect a −30 dBm 2.0 GHz signal to INPUT connector on Preslector.
9. Select n=1−/IF = 550 MHz Frequency BAND and tune Analyzer FREQUENCY control to center the 2.0 GHz signal on CRT display.
10. Reduce SCAN WIDTH PER DIVISION to 0.5 MHz keeping signal centered on display with FREQUENCY control.
11. Reduce SCAN WIDTH PER DIVISION to 100 kHz; center signal on display with FINE TUNE control.
12. Set LOG/LINEAR switch to LINEAR and LINEAR SENSITIVITY control to 1 mV/DIV.
13. Adjust Preselector FREQ OFFSET control to center YIG filter passband on the 2 GHz signal and maximize signal on CRT display.
14. Set Analyzer LOG/LINEAR control to 10 dB LOG.
15. Rotate LOG REF LEVEL control to −30 dBm.
16. Adjust LOG REF LEVEL Vernier control to position signal peak on LOG REF LEVEL graticule line.
17. Connect a −30 dBm 8.0 GHz signal to INPUT Connector on Preselector.
18. Select n = 2+/IF = 2050 MHz Frequency BAND on Analyzer, set SCAN WIDTH PER DIVISION to 10 MHz, and tune FREQUENCY control to center the 8.0 GHz signal on CRT display.
19. Reduce SCAN WIDTH PER DIVISION to 0.5 MHz keeping signal centered on display with FREQUENCY control.

Figure 3-5. 1.8 to 18 GHz YIG-Tuned Filter Operation (2 of 3)

OPERATOR'S CHECKS USING YIG-TUNED FILTER

20. Reduce SCAN WIDTH PER DIVISION to 100 kHz; center signal on display with FINE TUNE control.

21. Set LOG/LINEAR switch to LINEAR and LINEAR SENSITIVITY control to 1 mV/DIV.

22. Adjust Preselector TRACKING control to maximize signal on CRT display.

23. If signal is already at maximum, no further adjustment of FREQ OFFSET or TRACKING is required.

24. If signal is not at maximum, repeat steps 7 through 22 until a setting is found which satisfies requirements of steps 13 and 22.

NOTE

Incorrect tracking of preselector to the Spectrum Analyzer may be due to aging or misadjustment of the 8555A YIG Driver Assembly. Follow the directions given in Section V of the 8555A Operating and Service Manual under YIG Driver Adjustments.

25. To check YIG filter tuning by an external dc voltage, set the −30 dBm signal source to 2 GHz and the 8555A to a band to display this frequency. Disconnect the W3 interrconnect cable from the rear of either the 8445B or the 8555A.

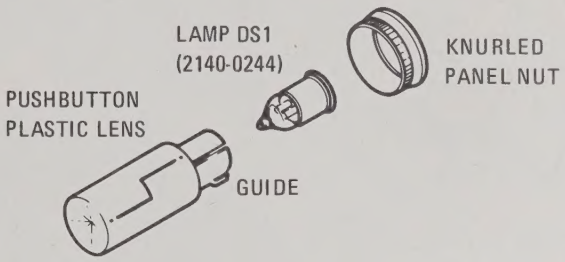
26. Apply a positive voltage from a variable dc power supply to the center connection of the REMOTE input BNC connector at the rear of the 8445B. Monitor the REMOTE input voltage with a voltmeter. The signal on the CRT should peak at +2 volts. (If not, the Remote Control Buffer Amplifier, described in Service Sheet 5, should be checked.)

27. Adjust signal source to 4 GHz and vary the dc voltage. The signal should peak on the CRT at +4 volts.

NOTE

When switching the 8555A INPUT ATTENUATION from 10 dB to 0 dB, signal level displayed on CRT may not change by 10 dB. This is due to the high mismatch error between the 8445B OUTPUT port and the 8555A INPUT port.

Figure 3-5. 1.8 to 18 GHz YIG-Tuned Filter Operation (3 of 3)



POWER LAMP REPLACEMENT

1. Remove lens by pulling straight out.
2. Replace lamp.
3. To replace lens, align guide with notch in receptacle. Push straight in.

Figure 3-6. Power Lamp Replacement

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